1022 Echo in Coronary Artery Disease

Wednesday, March 27, 1996, Noon–2:00 p.m.
Orange County Convention Center, Hall E
Presentation Hour: 1:00 p.m.–2:00 p.m.

1022-60 The Cost of a Useful Echocardiogram in Patients Admitted to the Coronary Care Unit

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A prospective study was carried out in 133 consecutive patients (pts) admitted to the Coronary Care Unit (CCU) to determine the cost of a useful echocardiogram (echo), defined as one which influenced diagnosis (25%), prognosis (23%) and/or treatment (17%). Admission diagnoses were unstable angina (UA)-34%, arrhythmia (ARR)-14%, congestive heart failure (CHF)-8%, post-procedure (PROC)-7%, acute myocardial infarction (AMI)-6%, and miscellaneous (MISC)-20%. A useful echo was noted in 29% of pts. Pts without a recent (within 3 months) echo were twice as likely to have a useful echo (33/99 = 33%) as those with a recent echo (5/34 = 15%). A cardiologist predicted the overall usefulness of echo with a positive predictive accuracy of 54% and a negative predictive accuracy of 94%. None of the 6% false negative echoes occurred in a patient with a recent echo. Echo was most often useful in pts with CHF (64%) and least often useful in pts admitted post-PROC (4%). The cost of a useful echo (defined as the unit cost of $330 × [total echoes ÷ useful echoes]) was $1155 (3.5u); for those predicted important $627 (1.9u); for those predicted not important $5511 (16.7u) and per admission diagnosis UA $957 (2.9u); ARR $2343 (7.1u); CHF $528 (1.6u); PROC $8250 (25u); AMI $1320 (4u); MISC $1650 (5u). In conclusion, echo is an important diagnostic tool in CCU pts. The usefulness of echo is influenced significantly by the admission diagnosis, clinicians judgement and the availability of a recent echo.

1022-61 Admission Echocardiography Predicts In-Hospital Cardiac Events in Patients With Unstable Angina

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Risk-stratification parameters with a sufficiently high negative predictive value (NPV) to permit safe, cost-effective triage have not been identified for patients presenting with unstable angina. The potential for admission echocardiography to contribute to the management of unstable angina patients was studied in 63 patients. *Methods:* Echocardiographic wall motion score index (WMSI), ejection fraction (LVEF), and severity of mitral regurgitation (MR) were determined within 24 hours of admission. In-hospital endpoints were: MI/death (MI or death) and major events (MI, death, CHF, or ventricular tachyarrhythmia). The sensitivity (sens), specificity (spec), negative predictive value (NPV), and chi-square contingency probability (p) of the echocardiographic parameters were determined. *Results:* The MI/death and major event rates were 11% and 19%.

		MI/Death				Major Events			
		sens	spec	NPV	p	sens	spec	NPV	p
A	MR ≥ 2+	86	84	97	0.011	75	87	92	0.008
B	WMSI ≥ 0.2	71	68	95	0.042	75	73	93	0.002
C	LVEF < 40%	71	87	96	< 0.001	58	90	90	< 0.001
	B or C	86	63	97	0.015	92	69	97	< 0.001
	A or B or C	100	54	100	0.007	100	59	100	< 0.001

Conclusions: Admission echocardiography can help discriminate between unstable angina patients who are at high and low risk for in-hospital cardiac events. The very high NPV of a composite echocardiographic index that incorporates LVEF, WMSI, and MR severity may facilitate rational triage of patients with unstable angina.

1022-62 Early Hospital Discharge for Acute Myocardial Infarction Using Echocardiography (Day 3) and Clinical Criteria

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To compare patients at low risk versus intermediate or high risk shortly after myocardial infarction for cardiac death and cardiac events within 1 year follow-up, clinical and echocardiographic criteria were used, including age, presence of recurrent myocardial ischemia or post-infarction angina, severe noncardiac disease and echocardiography at day 3 (infarct size and distribution). Patients were prospectively categorized at low risk and were younger than 75 years, had relatively small infarct size (WMSI < 1.5) and no evidence of recurrent ischemia within 3 days. Thus, 144 consecutive patients were examined using 2-dimensional echocardiography at day 3, of whom 55 patients (38%) were allocated to the low risk group (group I) and 89 patients (62%) to the intermediate or high risk group (group II). Complete 1-year follow-up was obtained in all patients.

Results	Group I	Group II	P-value
Revascularization	8 (14.5%)	20 (22.5%)	ns
Recurrent MI	2 (3.6%)	6 (6.7%)	ns
Heart failure	1 (1.8%)	7 (7.9%)	ns
Cardiac death	1 (1.8%)	16 (18.0%)	<0.05

Conclusion: Echocardiography at day 3 in conjunction with clinical data is a safe and cost-effective means to stratify patients for early hospital discharge.

1022-63 Detection of Internal Mammary Artery Graft Stenosis Using Flow Reserve Measurement: Assessment by Supraclavicular Doppler Echocardiography

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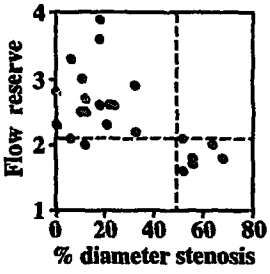
Doppler Echocardiography from supraclavicular approach can be used to measure blood flow velocity of the internal mammary artery (IMA) graft and may provide a non-invasive assessment of flow reserve. To evaluate the usefulness of flow reserve assessed by supraclavicular Doppler echocardiography for detection of IMA graft stenosis, 24 patients were studied. All patients received coronary artery bypass grafting using IMA graft to the left anterior descending coronary artery. All patients underwent supraclavicular Doppler echocardiography and quantitative coronary angiography (QCA). Flow reserve of IMA graft was determined as the ratio of diastolic mean velocity during adenosine triphosphate infusion to that at baseline. *Results:* QCA showed moderate IMA graft stenosis (52 to 68% diameter stenosis) in 6 of 24 patients. Flow reserve < 2.1 predicted significant IMA graft stenosis (> 50% diameter stenosis) with a sensitivity and specificity of 83% (5/6) and 94% (17/18), respectively.



Conclusion: Flow reserve assessed by supraclavicular Doppler echocardiography is a reliable method for detection of IMA graft stenosis.

1022-64 Split Screen Analysis of Stress Echocardiography Does Not Significantly Improve Sensitivity in Detecting Coronary Artery Disease

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To investigate the claim that computer assisted split screen analysis of stress echocardiography improves accuracy of diagnosis we studied 94 patients using Bruce protocol treadmill exercise echocardiography (ESE) and dobutamine stress echocardiography (DSE) 5–40 mcg/kg/min in 3 min stages. Significant coronary artery disease (CAD) was defined as > 70% stenosis in a major epicardial coronary artery on angiography. Stress echo images were acquired on videotape at rest and post peak stress for the ESE and at each stage for the DSE using a Hewlett-Packard 77020AC system. Cine loop analysis using a split screen format and side by side comparison of rest and stress images was performed using a Nova Microsonics digital frame grabbing system. Images were analysed by operators blinded to all other findings. 15 subjects (16%) had no significant coronary stenoses, 28 (30%) one vessel disease (1VD), 24 (26%) two vessel disease (2VD) and 27 (29%) multi-vessel disease (MVD). Overall specificity for the detection of CAD was 87% with ESE and 93% with DSE.

Table: Sensitivity for the detection of coronary artery disease

Mode of Analysis	Exercise Echo		Dobutamine Echo	
	Video	Split Screen	Video	Split Screen
IVD	54%	57%	61%	57%
2VD	71%	71%	79%	75%
MVD	77%	77%	89%	85%
Overall	67%	68%	76%	72%

We conclude that split screen analysis does not significantly improve the diagnosis of coronary artery disease and, while it may be a convenient way to analyse and store images, it is not a necessity for the interpretation of stress echocardiograms.

1022-65 Diagnostic Accuracy of Digital Echocardiography

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Digital echocardiography (echo) with its ability to view cine loop images side-by-side has facilitated stress echo. This digital scheme which uses minimum frames, cycles and resolution, should also have potential for routine echo. In order to evaluate the diagnostic accuracy of digital echo, 2–3 MByte digital and standard videotape recordings were obtained on 301 consecutive, routine transthoracic 2D, Doppler and M-mode echoes on 282 pts with various diagnoses. The mean age was 57. A single investigator first interpreted the digital recording, then reviewed the videotape and made additions or corrections. In 286 or 95% of the studies the digital and videotape interpretations were identical. In 8 of the discrepancies the abnormality was visible on the digital recording but was seen better on videotape. In 7 pts or 2.3% an abnormality was missed on the digital recording. These abnormalities included a thickened aortic valve, an aortic vegetation, 2 pts with abnormal septal motion and an ischemic wall motion abnormality. In 2 pts an abnormality (inferior vena cava dilatation, mitral regurgitation) was not recorded digitally. This study suggests that digital echo shows the pertinent clinical information in the vast majority of routine, adult transthoracic studies and reliably provides side-by-side comparison of serial studies and rapid reviews that can be viewed on inexpensive computers or via modems. The few discrepancies indicate that as with stress echo a videotape recording should be used as a backup.

1022-66 Myocardial Enhancement Following Peripheral Intravenous Injection of Activated QW3600 (EchoGen) in Normal Human Volunteers

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Transpulmonary agents are currently limited to cavity contrast opacification with no clinically useful information regarding myocardial perfusion in humans. To determine the effect of EchoGen (dodecafluoropentane) on myocardial perfusion using very low doses, we performed intravenous injections of EchoGen after an immediately pre-injection activation treatment of the agent. Echocardiography was performed in short axis parasternal view in 7 normal volunteers. End diastolic frames were digitised using an off-line system (Power PC Macintosh 7100 with data translation frame grabber). Grey scale intensity was measured in the right ventricular cavity (RV), left ventricular cavity (LV), the anterior septal wall (VS) and inferior wall (IW) in each volunteer and expressed in grey scale units (GSU) before and at peak contrast enhancement. Three individuals received 0.02 ml/kg while 4 received 0.05 ml/kg, injected over a period of 10 seconds. The percent enhancement in each region was also calculated as the difference between the grey scale intensity at peak- and pre-injection normalised to the pre-injection multiplied by 100. The RV increased from 44.3 to 112.1 GSU ($p < 0.001$) 160%, LV from 40.1 to 105.1 GSU ($p < 0.001$) 160.1%, VS from 65.3 to 88 GSU ($p < 0.01$) 35.9% and IW from 63.1 to 85 GSU ($p < 0.01$) 34.6%. There were no complications or side effects and arterial saturations remained unchanged in all.

It is concluded that intravenous administration of very low dose of activated EchoGen emulsion is sufficient to produce a dramatic increase of both cavity contrast enhancement and provide myocardial perfusion information in normal human volunteers with no side/adverse effects.

1023 Transesophageal Echocardiography

Wednesday, March 27, 1996, Noon–2:00 p.m.
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1023-67 Partial Anomalous Pulmonary Venous Connection: Diagnosis by Transesophageal Echocardiography

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Partial anomalous pulmonary venous connection (PAPVC) is an uncommon congenital anomaly whose diagnosis has classically been made using angiography.

Between 1988 and 1995, 44 patients (pts), age 2 to 75 years (mean 41 yrs), with PAPVC, without complex congenital heart disease, underwent transesophageal echocardiography (TEE). Indication for TEE was right ventricular volume overload or intracardiac shunting suspected by transthoracic echocardiography (n = 30) or intraoperative TEE (n = 14). A total of 64 anomalous pulmonary venous connections were detected in 42 pts (1.52/pt). In 2 pts, TEE suggested, but did not diagnose, PAPVC. Right-sided anomalous veins were identified in 35 pts (83.3%), left-sided anomalous veins in 6 pts (14.3%), and bilateral in 1 pt (2.4%). One vein was anomalous in 23 pts (54.7%), 2 in 17 pts (40.5%), 3 in 1 pt (2.4%), and 4 in 1 pt (2.4%). The connecting site was the superior vena cava in 39 (60.9%), vertical vein to innominate vein in 10 (15.6%), right atrium in 8, right atrial-caval junction in 6, and inferior vena cava in 1. Sinus venosus ASD was the most common associated anomaly in 22 pts (50%), followed by secundum ASD in 6 pts and isolated patent foramen ovale in 2 pts. Surgical confirmation was made in 34 pts (n = 30) or other imaging technique (n = 4). TEE made the correct diagnosis in 32 pts (94.1%) and was suggestive in 2 pts (5.9%). All 55 PAPVC diagnosed by TEE were confirmed at surgery.

TEE is highly diagnostic for PAPVC and can obviate the need for angiography. Accurate anatomic diagnosis may influence the medical and surgical management. TEE should be performed in all pts with right ventricular volume overload when the precordial exam is inconclusive.

1023-68 Spontaneous Echo Contrast: Identification by Videodensity Analysis

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Left atrial spontaneous echo contrast (SEC) is associated with increased frequency of left atrial thrombus and embolic events. In pts with nonvalvular atrial fibrillation (NVAF), left atrial SEC on transesophageal echo (TEE) may identify a subset at higher risk for stroke. SEC is usually faint in NVAF pts, its assessment dependent on visual interpretation which can vary between observers.

35 NVAF pts at our institution underwent TEE as part of the Stroke Prevention in Atrial Fibrillation Trial. Off line videodensity analysis of the left atrial appendage (LAA) was done in 34 pts with adequate images using a 0.25 cm^2 region of interest. Videodensity was measured for every other frame for 6 cardiac cycles. Visual presence of SEC was determined by 2 observers unaware of the videodensity results and was compared with those measurements.

Results: Pts with SEC had significantly higher mean LAA videodensity ($p < 0.0001$) and greater variation in videodensity levels over the 6 cardiac cycles ($p < 0.0001$) as measured by standard deviation (SD). Importantly, variation in videodensity was highly specific for individual pts for the presence (SD > 5) or absence of SEC.

Pts	Videodensity		SEC	
	SD	MEAN	(+)	(–)
14	> 5	> 20	14	0
3	> 5	< 20	2	1
4	< 5	> 20	0	4
13	< 5	< 20	0	13

Conclusions: NVAF pts with LAA SEC have a typical videodensity pattern characterized by higher mean and more variable videodensity levels. This study suggests that SEC imaged by TEE can be objectively identified by videodensity analysis.